

CLAIMS

1. A multilayered sheet comprising:
 - a core layer comprising a thermoplastic polymer and an IR absorbing additive;
 - a first cap layer comprising a thermoplastic polymer and an electromagnetic radiation absorbing additive; wherein a surface of the first cap layer is disposed upon and in intimate contact with a surface of the core layer.
2. The sheet of Claim 1, further comprising a second cap layer comprising a thermoplastic polymer and an electromagnetic radiation absorbing additive; wherein the second cap layer is disposed upon and in intimate contact with a surface of the core layer opposite the surface in contact with the first cap layer.
3. The sheet of Claim 1, wherein the electromagnetic radiation absorbing additive is a UV absorber and/or an IR absorbing additive.
4. The sheet of Claim 1, wherein the IR absorbing additive is lanthanum boride (LaB_6), praseodymium boride (PrB_6), neodymium boride (NdB_6), cerium boride (CeB_6), gadolinium boride (GdB_6), terbium boride (TbB_6), dysprosium boride (DyB_6), holmium boride (HoB_6), yttrium boride (YB_6), samarium boride (SmB_6), europium boride (EuB_6), erbium boride (ErB_6), thulium boride (TmB_6), ytterbium boride (YbB_6), lutetium boride (LuB_6), strontium boride (SrB_6), calcium boride (CaB_6), titanium boride (TiB_2), zirconium boride (ZrB_2), hafnium boride (HfB_2), vanadium boride (VB_2), tantalum boride (TaB_2), chromium borides (CrB and CrB_2), molybdenum borides (MoB_2 , Mo_2B_5 and MoB), tungsten boride (W_2B_5), or a combination comprising at least one of the foregoing borides.
5. The sheet of Claim 1, wherein the IR absorbing additive comprises nanosized particles having average particle dimensions of less than or equal to about 200 nanometers.

6. The sheet of Claim 1, wherein the IR absorbing additive is present in amounts of about 0.001 to about 2.0 gram/square meter, measured with respect to the surface of the core layer.

7. The sheet of Claim 1, wherein the IR absorbing additive is present in amounts of about amounts of about 0.02 ppm to about 3000 ppm based on the total weight of the core layer.

8. The sheet of Claim 7, wherein the core layer comprises thermal stabilizers, and further wherein the thermal stabilizers are phosphites, phosphonites, phosphines, hindered amines, hydroxyl amines, phenols, acryloyl modified phenols, hydroperoxide decomposers, benzofuranone derivatives, or a combination comprising at least one of the foregoing antioxidants.

9. The sheet of Claim 8, wherein thermal stabilizers are present in an amount of about 0.001 to about 3 wt%, based on the total weight of the core layer.

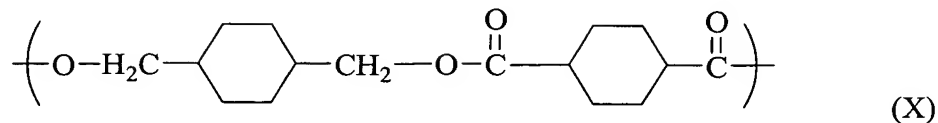
10. The sheet of Claim 8, wherein the core layer has a thickness of about 0.5 to about 30 mm.

11. The sheet of Claim 1, wherein the thermoplastic polymer is polyacetal, polyacrylic, polycarbonate, polystyrene, polyester, polyamide, polyamideimide, polyarylate, polyarylsulfone, polyethersulfone, polyphenylene sulfide, polyvinyl chloride, polysulfone, polyimide, polyetherimide, polytetrafluoroethylene, polyetherketone, polyether etherketone, polyether ketone ketone, polybenzoxazole, polyoxadiazole, polybenzothiazinophenothiazine, polybenzothiazole, polypyrazinoquinoxaline, polypyromellitimide, polyquinoxaline, polybenzimidazole, polyoxindole, polyoxoisindoline, polydioxoisindoline, polytriazine, polypyridazine, polypiperazine, polypyridine, polypiperidine, polytriazole, polypyrazole, polypyrrolidine, polycarborane, polyoxabicyclononane, polydibenzofuran, polyphthalide, polyacetal, polyanhydride, polyvinyl ether, polyvinyl thioether, polyvinyl alcohol, polyvinyl ketone, polyvinyl halide, polyvinyl nitrile, polyvinyl ester, polysulfonate, polysulfide, polythioester, polysulfone, polysulfonamide, polyurea, polyphosphazene, polysilazane, or a combination comprising at least one of the foregoing thermoplastic polymers..

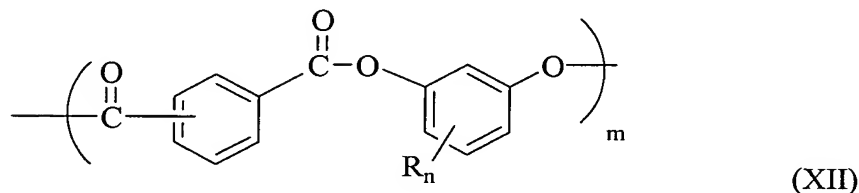
12. The sheet of Claim 1, wherein the thermoplastic polymer is bisphenol A polycarbonate, copolyestercarbonate, or a blend of polyester with polycarbonate.

13. The sheet of Claim 1, wherein the polyester is a cycloaliphatic polyester, a polyarylates or a combination of a cycloaliphatic polyester with a polyarylate.

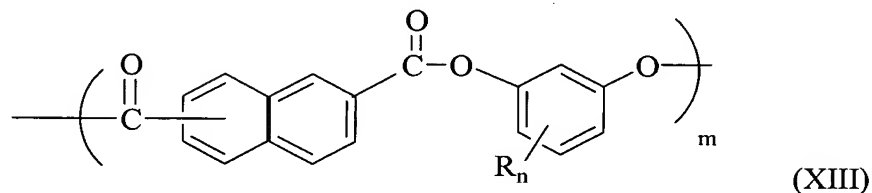
14. The sheet of Claim 13, wherein the cycloaliphatic polyester has the structure (X)



15. The sheet of Claim 13, wherein the polyarylate is resorcinol arylate polyesters having the structure (XII)

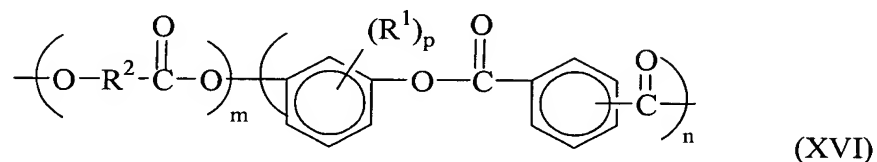


or the structure (XIII)



where R is a C₁₋₁₂ alkyl or halogen, n is 0 to 3, and m is at least about 8.

16. The sheet of Claim 13, wherein the polyarylates are further copolymerized to form block copolyestercarbonates, comprising structural units of the formula (XVI)



wherein each R¹ is independently halogen or C₁₋₁₂ alkyl, m is at least 1, p is about 0 to about 3, each R² is independently a divalent organic radical, and n is at least about 4.

17. The sheet of Claim 1, wherein the UV absorbers are benzophenones, benzotriazoles, salicylates, resorcinol monobenzoate, 2'ethyl hexyl-2-cyano, 3-phenylcinnamate, 2- ethyl-hexyl-2-cyano-3,3-diphenyl acrylate, ethyl-2-cyano-3,3-diphenyl acrylate, [2-2'-thiobis(4-t-octylphenolate)-1-n-butylamine, or combinations comprising at least one of the foregoing UV absorbers and wherein the UV absorbers are present in an amount of 5 to about 15 wt%, based on the total weight of the first cap layer.

18. The sheet of Claim 2, wherein the UV absorbers are benzophenones, benzotriazoles, salicylates, resorcinol monobenzoate, 2'ethyl hexyl-2-cyano, 3-phenylcinnamate, 2- ethyl-hexyl-2-cyano-3,3-diphenyl acrylate, ethyl-2-cyano-3,3-diphenyl acrylate, [2-2'-thiobis(4-t-octylphenolate)-1-n-butylamine, or combinations comprising at least one of the foregoing UV absorbers and wherein the UV absorbers are present in an amount of 5 to about 15 wt%, based on the total weight of the first cap layer.

19. The sheet of Claim 1, having an infrared absorption of greater than or equal to about 20%.

20. The sheet of Claim 1, having a transmissivity of greater than or equal to about 40% in the visible light region.

21. The sheet of Claim 1, having an infrared absorption of greater than or equal to about 20%, an ultraviolet radiation absorption of greater than or equal to about 20%, and a transmissivity of greater than or equal to about 40% in the visible region.

22. A method for manufacturing a multilayered sheet comprising:

disposing a first cap layer comprising a thermoplastic polymer and an ultraviolet radiation absorbing additive onto a surface of a core layer comprising a thermoplastic polymer and an IR absorbing additive.

23. The method of Claim 22, wherein the core layer is produced simultaneously or sequentially with the first cap layer.

24. The method of Claim 22, further comprising disposing a second cap layer comprising a thermoplastic polymer and an ultraviolet radiation absorbing additive onto a surface of the core layer opposite the surface contacting the first cap layer.

25. The method of Claim 24, wherein the second cap layer is produced simultaneously or sequentially with the first cap layer and/or the core layer.

26. The method of Claim 22, wherein the disposing is conducted in a two roll mill or a three roll mill.

27. The method of Claim 22 further comprising thermoforming, vacuum molding, blow molding, injection molding, and/or compression molding the multilayered sheet.

28. A method for manufacturing a multilayered sheet comprising:

co-extruding a core layer comprising a thermoplastic polymer and an IR absorbing additive with a first cap layer comprising a thermoplastic polymer and an ultraviolet radiation absorber.

29. The method of Claim 28, further comprising co-extruding a second cap layer with the first cap layer and the core layer.

30. The method of Claim 28, further comprising laminating the multilayered sheet.

31. An article comprising the sheet of Claim 1.

32. An article comprising the sheet of Claim 2.

33. An article made by the method of Claim 22.

34. An article made by the method of Claim 28.